

Williams®

16P-3001-101 R-T
April, 1981

DEFENDER



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Williams® 
ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
(312) 267-2240

SPECIAL NOTES

CPU/Video Board

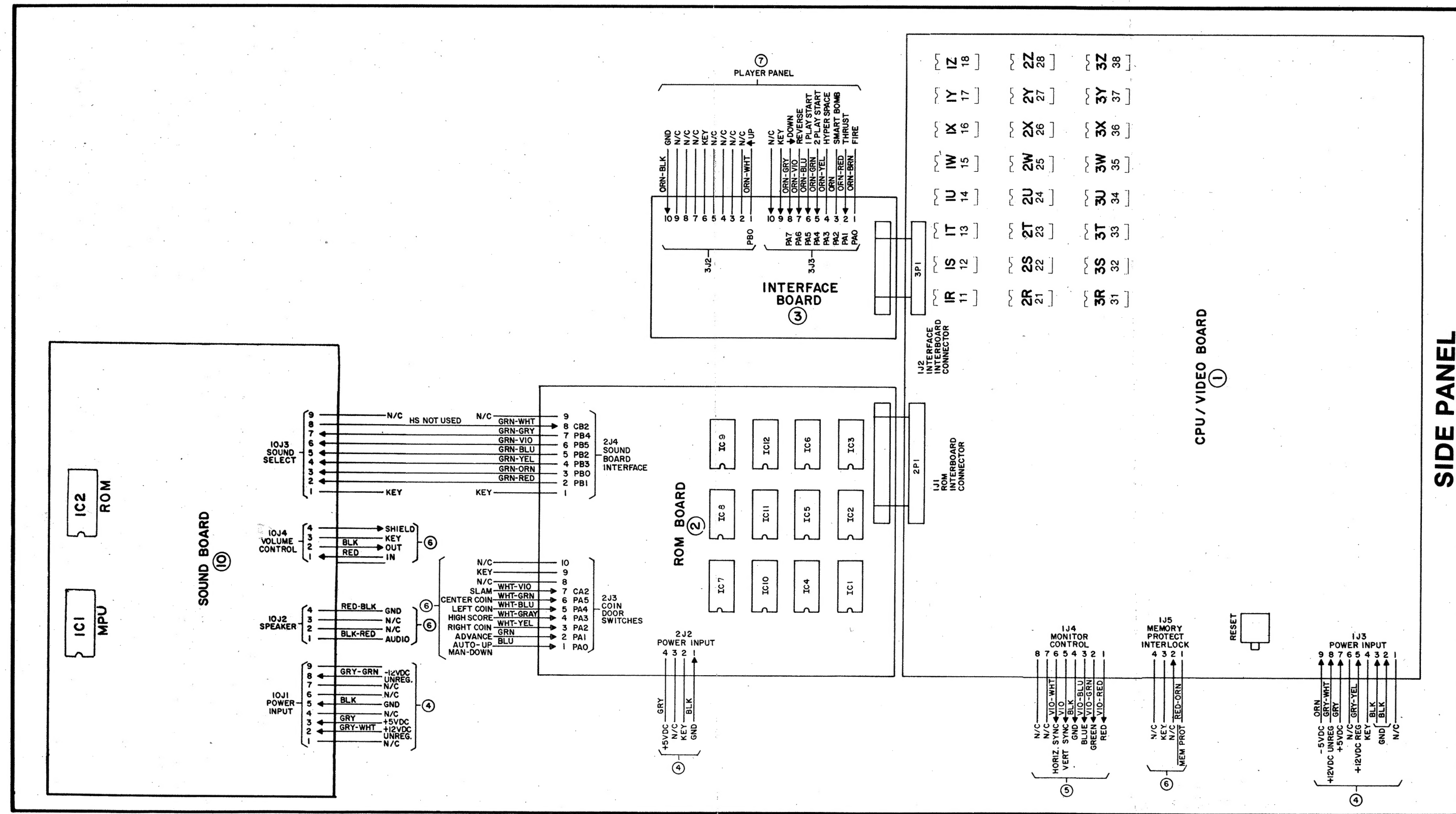
Requires Decoder ROM 2 at location 3K and Decoder ROM 3 at location 3E.

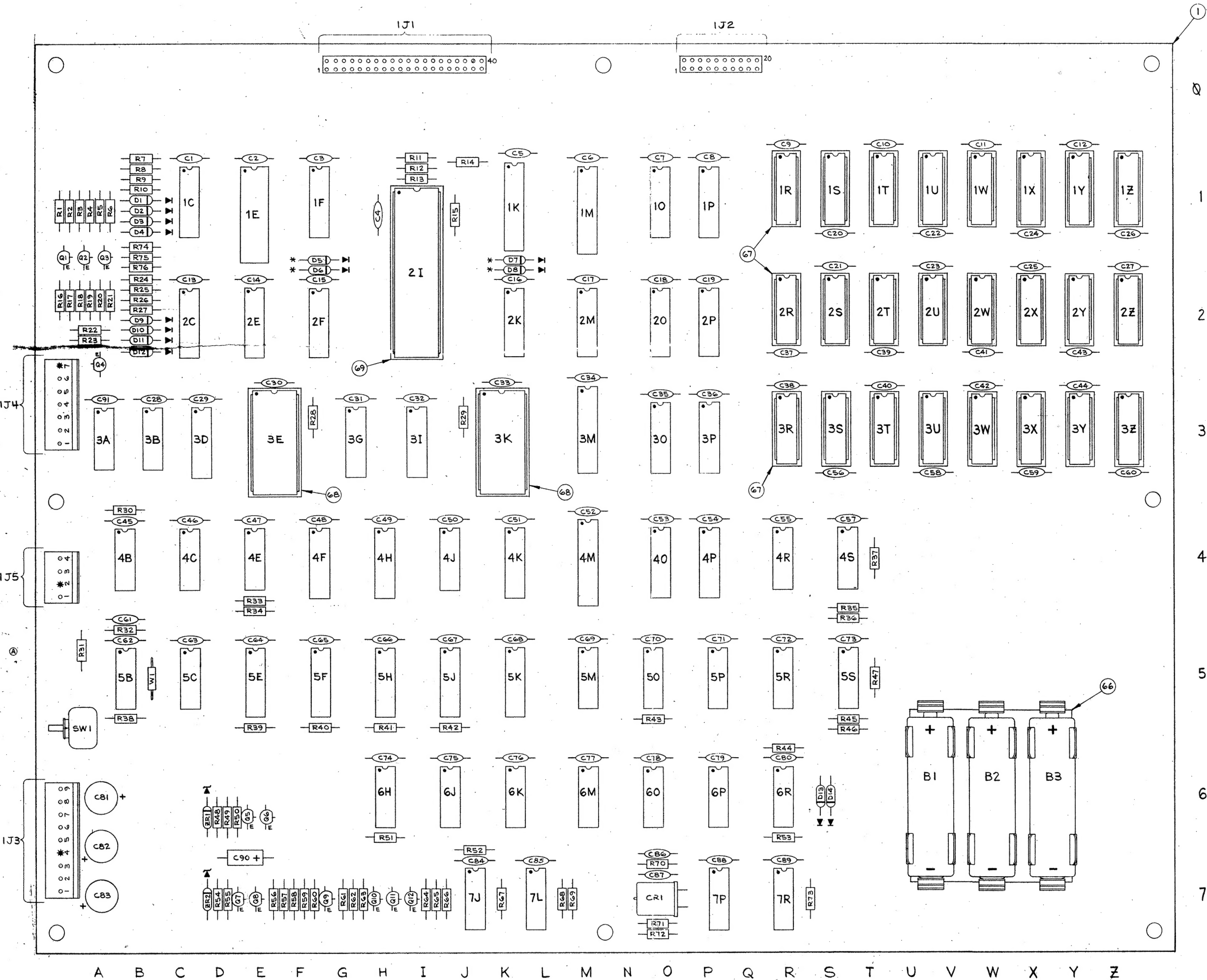
Interface Board

Jumper W1 must be installed. If red-labeled ROMS are not used, W2 must be removed.

CONTENTS

Interboard Wiring Diagram	3
R8570 CPU/Video Board Assembly Drawing	4
R8570 CPU/Video Board Logic Diagram (1 of 2)	5
R8570 CPU/Video Board Logic Diagram (2 of 2)	6
C8573 Interface Board Assembly and Logic Diagram	7
D8572 ROM Board Assembly Drawing	8
D8572 ROM Board Logic Diagram	9
D8359 Power Supply Board Assembly Drawing	10
D8359 Power Supply Board Schematic Diagram	11
Power Wiring Diagram	12
D8373 Power Panel Assembly Drawing	13
D8121 Sound Board Assembly Drawing	14
D8121 Sound Board Logic Diagram	15
D8224 Sound Board Assembly Drawing	16
D8224 Sound Board Logic Diagram	17
Cabinet Wiring Diagram	18

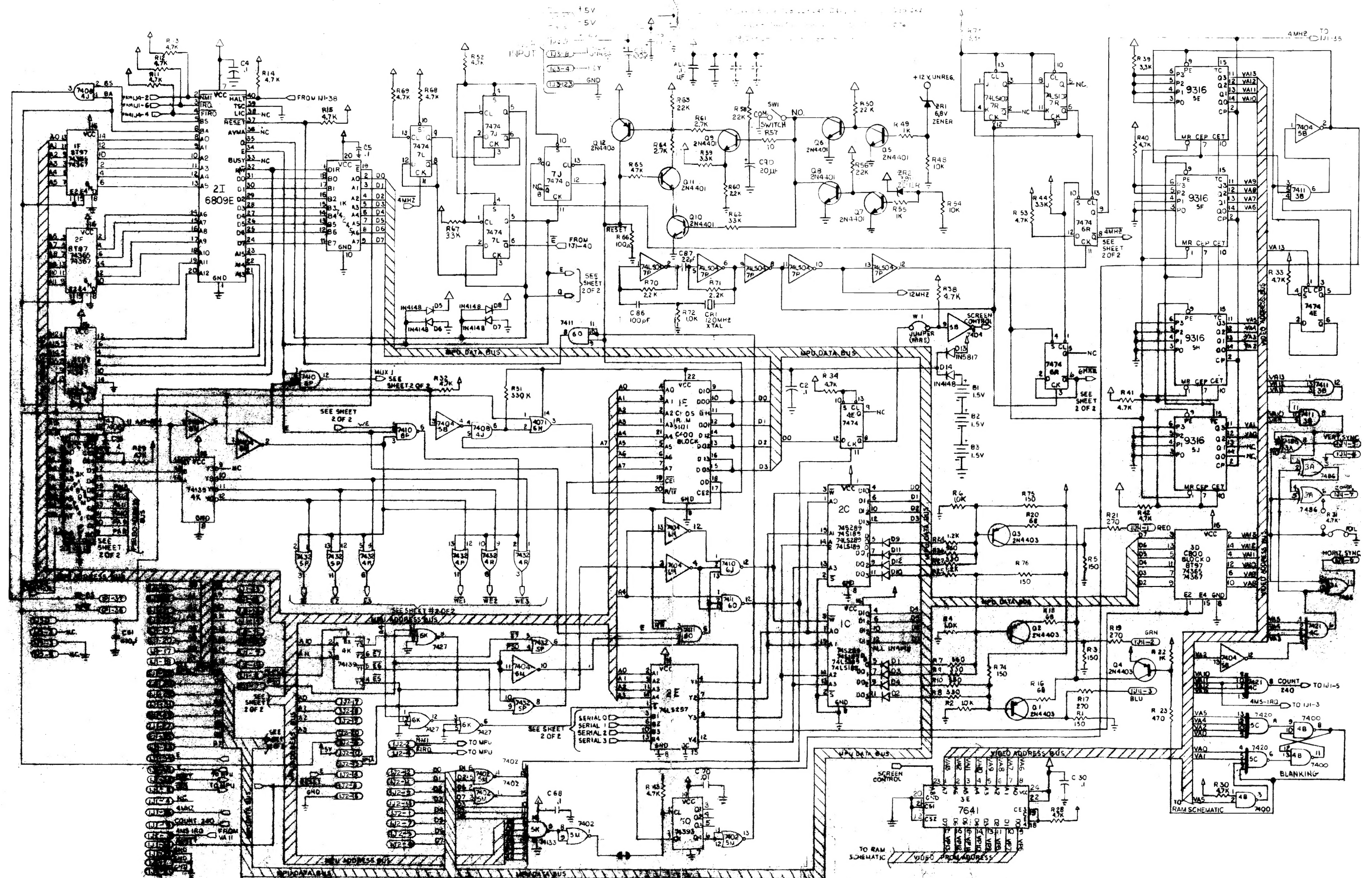




NOTES:

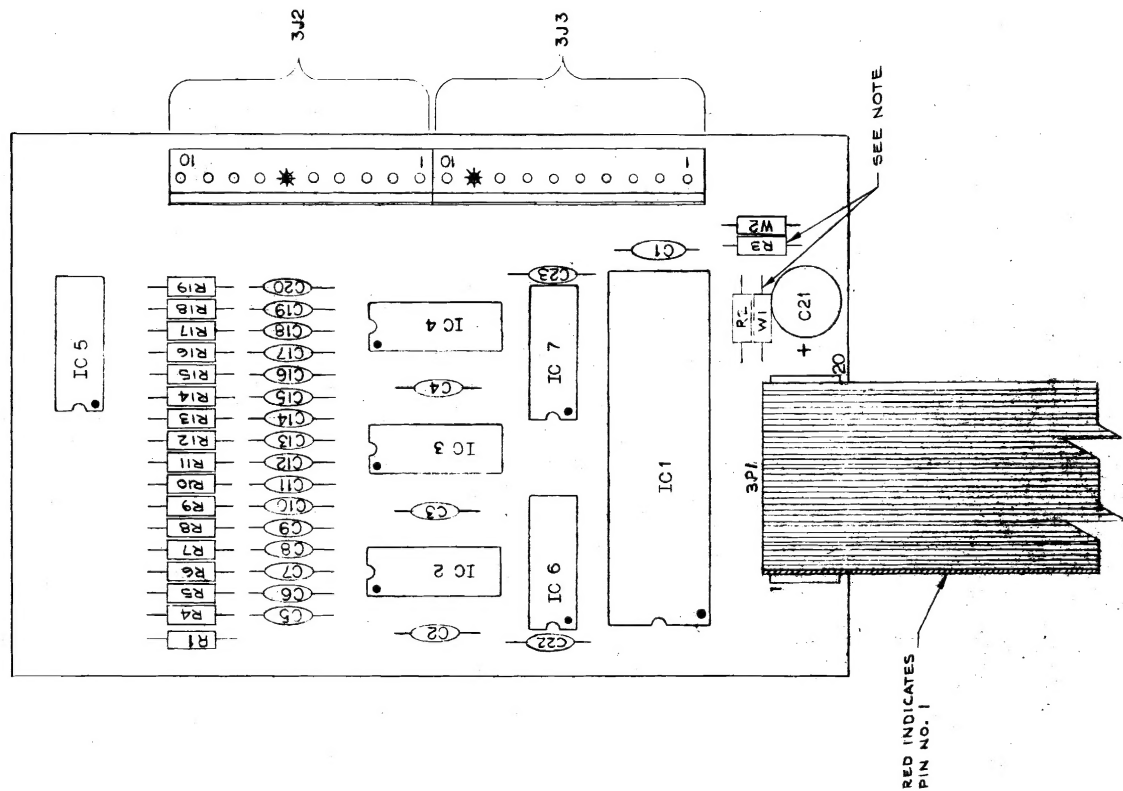
1. ALL: 1R, 1S, 1T, 1U, 1V, 1W, 1X, 1Y, 1Z, 2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 2L, 2M, 2N, 2O, 2P, 2Q, 2R, 2S, 2T, 2U, 2V, 2W, 2X, 2Y, 2Z, 3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 3I, 3J, 3K, 3L, 3M, 3N, 3O, 3P, 3Q, 3R, 3S, 3T, 3U, 3V, 3W, 3X, 3Y, 3Z.
2. 1K RESISTORS:
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100.
3. 1M RESISTORS:
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100.
4. 1N4148 DIODES:
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25, D26, D27, D28, D29, D30, D31, D32, D33, D34, D35, D36, D37, D38, D39, D40, D41, D42, D43, D44, D45, D46, D47, D48, D49, D50, D51, D52, D53, D54, D55, D56, D57, D58, D59, D60, D61, D62, D63, D64, D65, D66, D67, D68, D69, D70, D71, D72, D73, D74, D75, D76, D77, D78, D79, D80, D81, D82, D83, D84, D85, D86, D87, D88, D89, D90, D91, D92, D93, D94, D95, D96, D97, D98, D99, D100.
5. * THESE COMPONENTS ARE NOT USED IN THIS GAME - DEFENDER.

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	QTY	REMARKS
1	5170	09514-00	BARE P.C. BOARD	1	
2	5180	09515-00	QUAD 2-INPUT NAND	1	
3	5180	09515-00	QUAD 2-INPUT NOR	1	
4	5181	09515-00	HEX INVERTER	1	
5	5180	09515-00	QUAD 4-INPUT NAND	2	
6	5180	09515-00	QUAD 4-INPUT NOR	2	
7	5180	09515-00	QUAD 4-INPUT OR	2	
8	5180	09515-00	QUAD 4-INPUT AND	2	
9	5180	09515-00	QUAD 4-INPUT XOR	2	
10	5180	09515-00	QUAD 4-INPUT OR	2	
11	5180	09515-00	QUAD 4-INPUT AND	2	
12	5180	09515-00	QUAD 4-INPUT XOR	2	
13	5180	09515-00	QUAD 4-INPUT OR	2	
14	5180	09515-00	QUAD 4-INPUT AND	2	
15	5180	09515-00	QUAD 4-INPUT XOR	2	
16	5180	09515-00	QUAD 4-INPUT OR	2	
17	5180	09515-00	QUAD 4-INPUT AND	2	
18	5180	09515-00	QUAD 4-INPUT XOR	2	
19	5180	09515-00	QUAD 4-INPUT OR	2	
20	5180	09515-00	QUAD 4-INPUT AND	2	
21	5180	09515-00	QUAD 4-INPUT XOR	2	
22	5180	09515-00	QUAD 4-INPUT OR	2	
23	5180	09515-00	QUAD 4-INPUT AND	2	
24	5180	09515-00	QUAD 4-INPUT XOR	2	
25	5180	09515-00	QUAD 4-INPUT OR	2	
26	5180	09515-00	QUAD 4-INPUT AND	2	
27	5180	09515-00	QUAD 4-INPUT XOR	2	
28	5180	09515-00	QUAD 4-INPUT OR	2	
29	5180	09515-00	QUAD 4-INPUT AND	2	
30	5180	09515-00	QUAD 4-INPUT XOR	2	
31	5180	09515-00	QUAD 4-INPUT OR	2	
32	5180	09515-00	QUAD 4-INPUT AND	2	
33	5180	09515-00	QUAD 4-INPUT XOR	2	
34	5180	09515-00	QUAD 4-INPUT OR	2	
35	5180	09515-00	QUAD 4-INPUT AND	2	
36	5180	09515-00	QUAD 4-INPUT XOR	2	
37	5180	09515-00	QUAD 4-INPUT OR	2	
38	5180	09515-00	QUAD 4-INPUT AND	2	
39	5180	09515-00	QUAD 4-INPUT XOR	2	
40	5180	09515-00	QUAD 4-INPUT OR	2	
41	5180	09515-00	QUAD 4-INPUT AND	2	
42	5180	09515-00	QUAD 4-INPUT XOR	2	
43	5180	09515-00	QUAD 4-INPUT OR	2	
44	5180	09515-00	QUAD 4-INPUT AND	2	
45	5180	09515-00	QUAD 4-INPUT XOR	2	
46	5180	09515-00	QUAD 4-INPUT OR	2	
47	5180	09515-00	QUAD 4-INPUT AND	2	
48	5180	09515-00	QUAD 4-INPUT XOR	2	
49	5180	09515-00	QUAD 4-INPUT OR	2	
50	5180	09515-00	QUAD 4-INPUT AND	2	
51	5180	09515-00	QUAD 4-INPUT XOR	2	
52	5180	09515-00	QUAD 4-INPUT OR	2	
53	5180	09515-00	QUAD 4-INPUT AND	2	
54	5180	09515-00	QUAD 4-INPUT XOR	2	
55	5180	09515-00	QUAD 4-INPUT OR	2	
56	5180	09515-00	QUAD 4-INPUT AND	2	
57	5180	09515-00	QUAD 4-INPUT XOR	2	
58	5180	09515-00	QUAD 4-INPUT OR	2	
59	5180	09515-00	QUAD 4-INPUT AND	2	
60	5180	09515-00	QUAD 4-INPUT XOR	2	
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68	5180	09515-00	QUAD 4-INPUT AND	2	
69	5180	09515-00	QUAD 4-INPUT XOR	2	
70	5180	09515-00	QUAD 4-INPUT OR	2	
71	5180	09515-00	QUAD 4-INPUT AND	2	
72	5180	09515-00	QUAD 4-INPUT XOR	2	
73	5180	09515-00	QUAD 4-INPUT OR	2	
74	5180	09515-00	QUAD 4-INPUT AND	2	
75	5180	09515-00	QUAD 4-INPUT XOR	2	

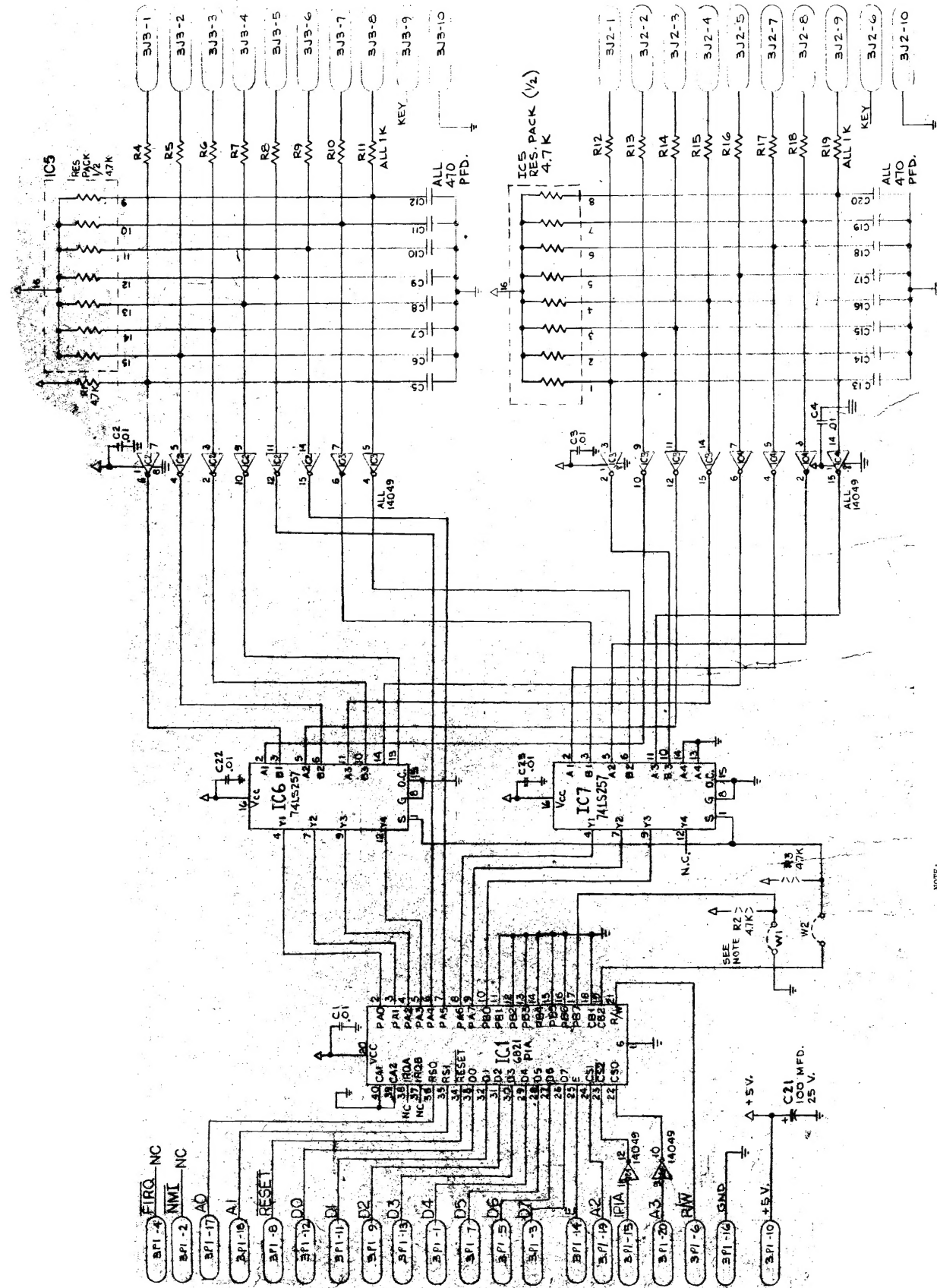


R8570 CPU/Video Board Logic Diagram
(Sheet 1 of 2)

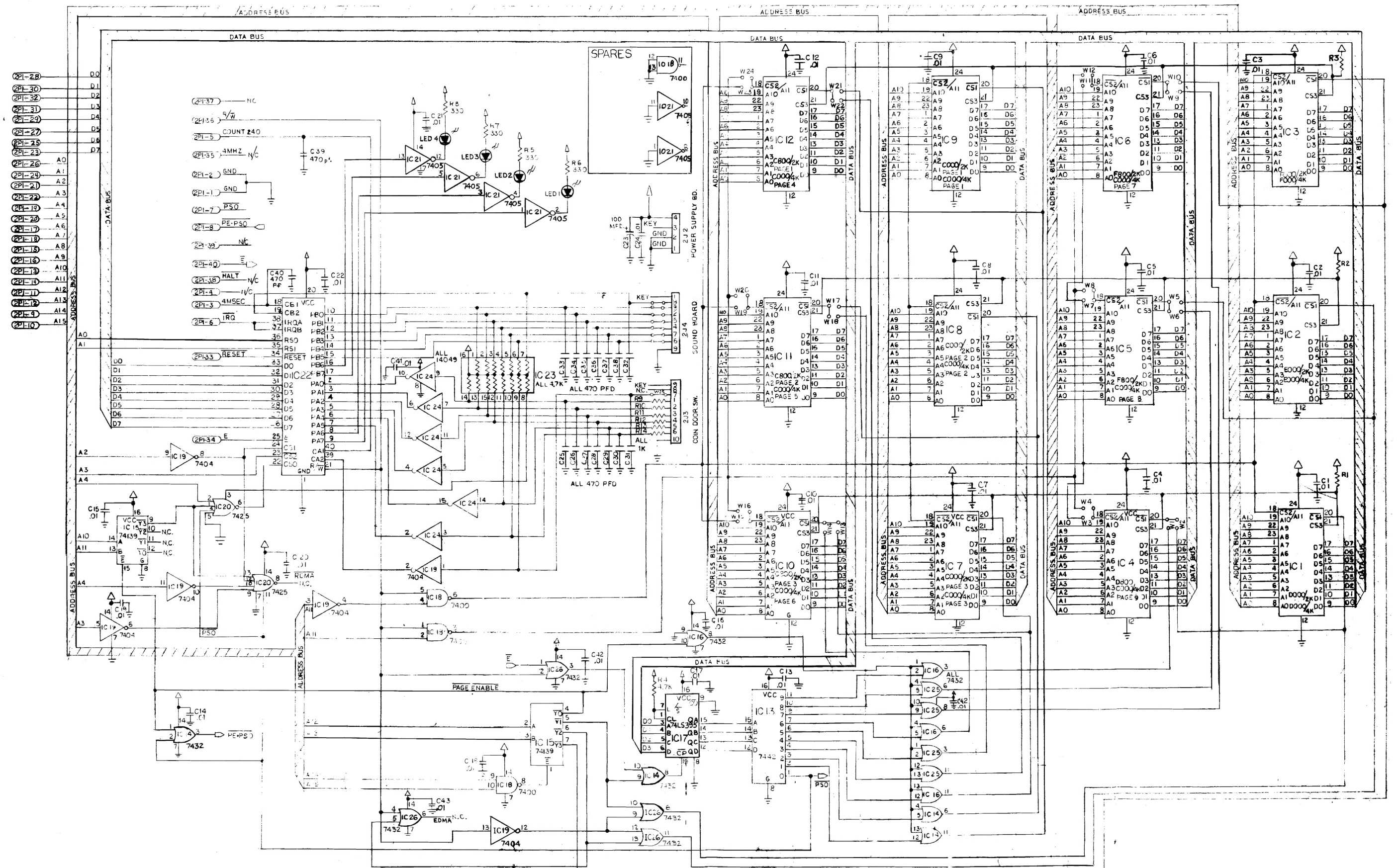
BILL OF MATERIALS				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	NO. REQ'D
1	5372-00	IC1	74LS164	1
2	5310-00	IC2	74LS164	3
3	08775-00	IC3	74LS164	1
4	5381-00	IC4	74LS164	2
5	08775-00	IC5	74LS164	3
6	08775-00	IC6	74LS164	16
7	08775-00	IC7	74LS164	16
8	08775-00	IC8	74LS164	16
9	08775-00	IC9	74LS164	16
10	08775-00	IC10	74LS164	16
11	08775-00	IC11	74LS164	16
12	08775-00	IC12	74LS164	16
13	08775-00	IC13	74LS164	16



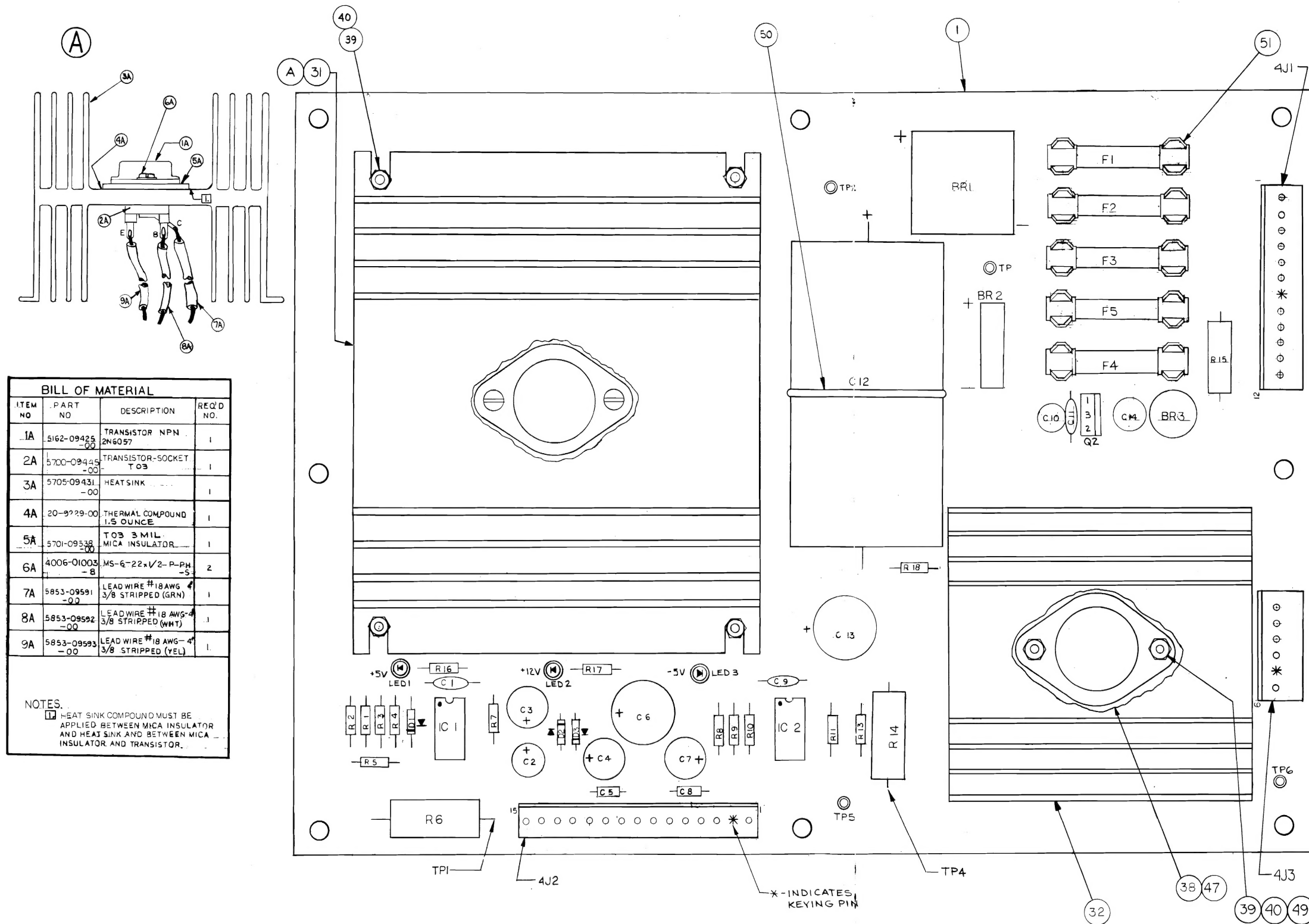
NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.
FOR UPRIGHT GAMES, W1 MUST BE CONNECTED AND W2 MUST BE REMOVED.
WITH RED-LABELLED ROMS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.



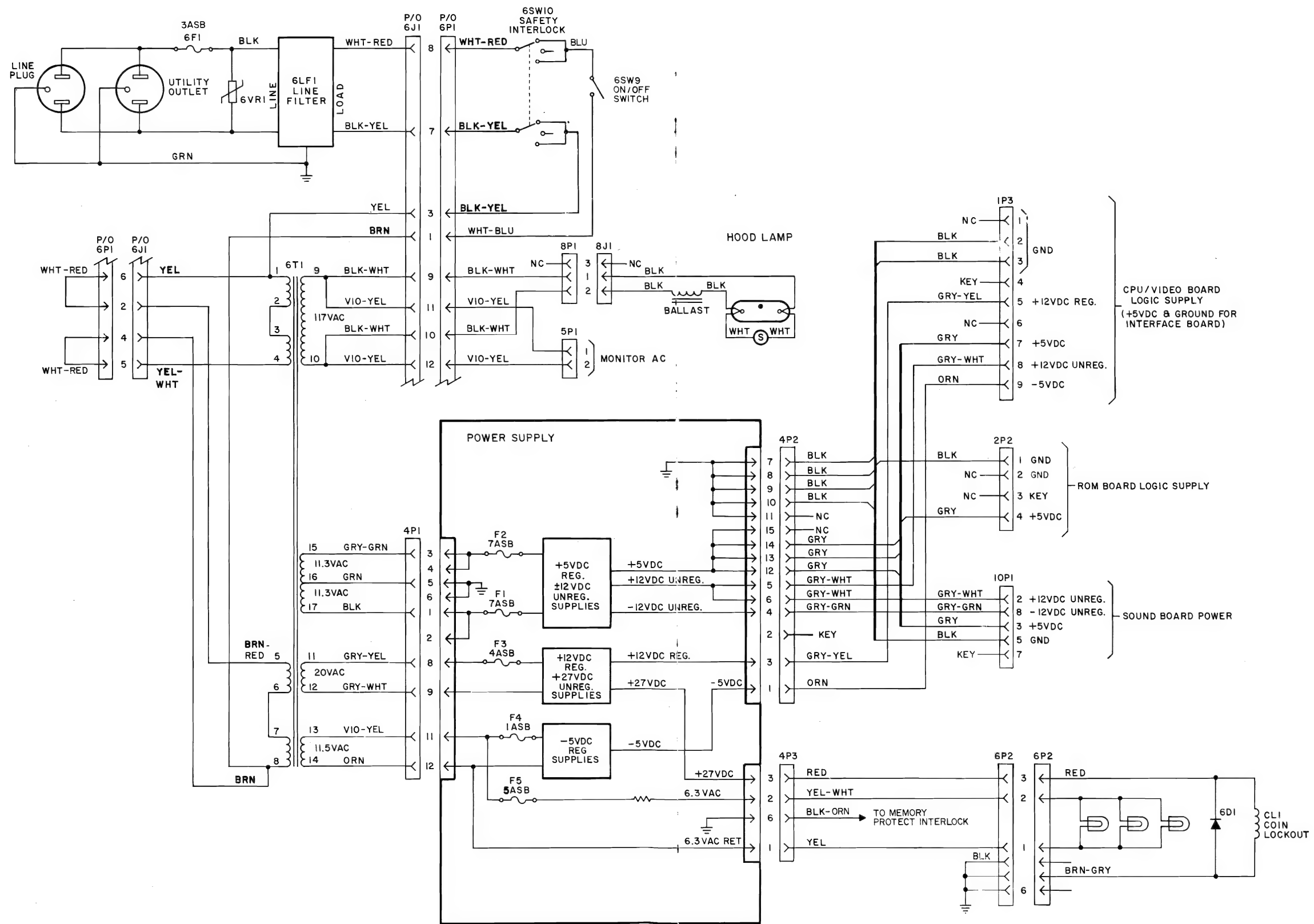
NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.
FOR UPRIGHT GAMES, W1 MUST BE CONNECTED AND W2 MUST BE REMOVED.
WITH RED-LABELLED ROMS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.



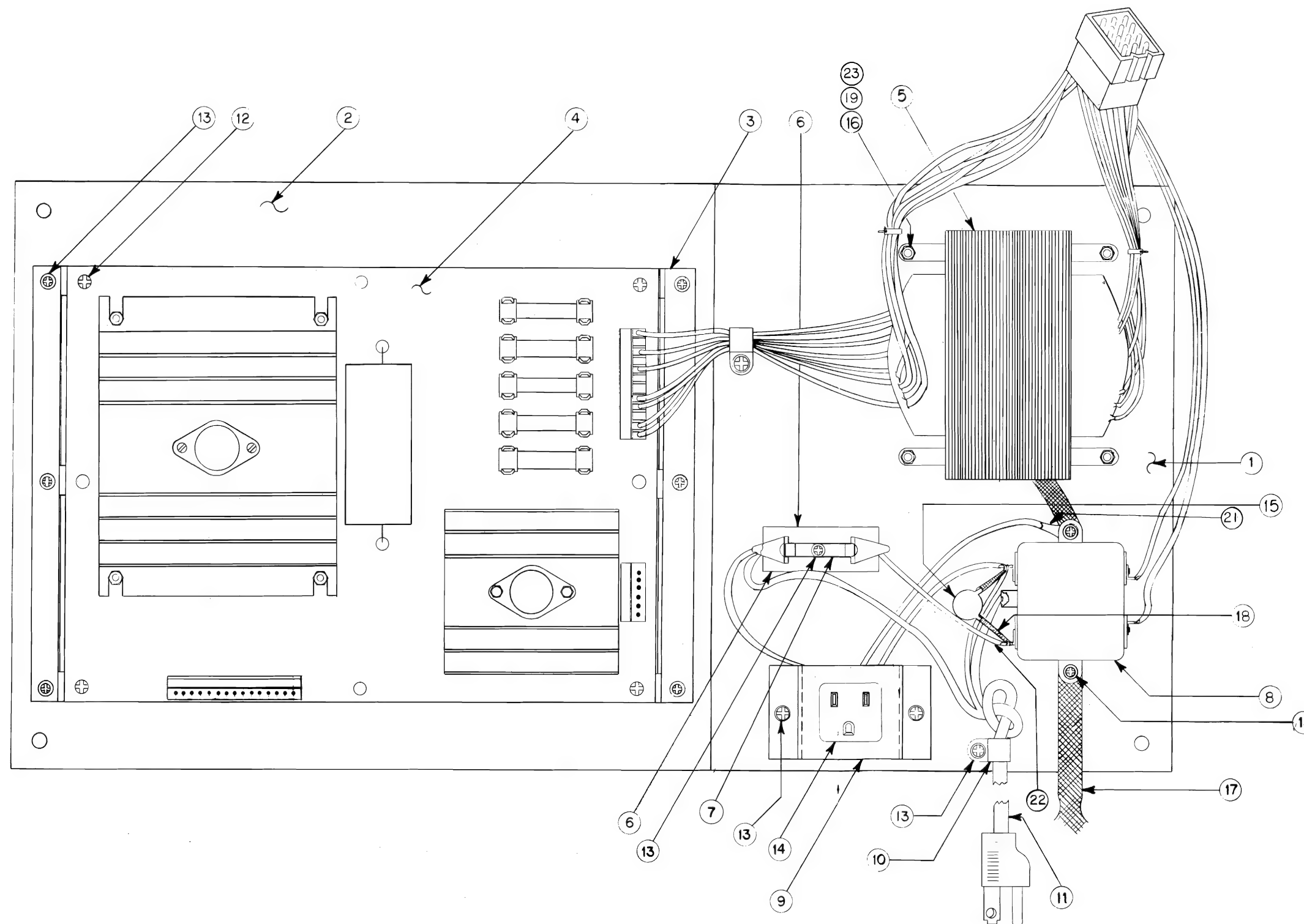
D8572 ROM Board Logic Diagram



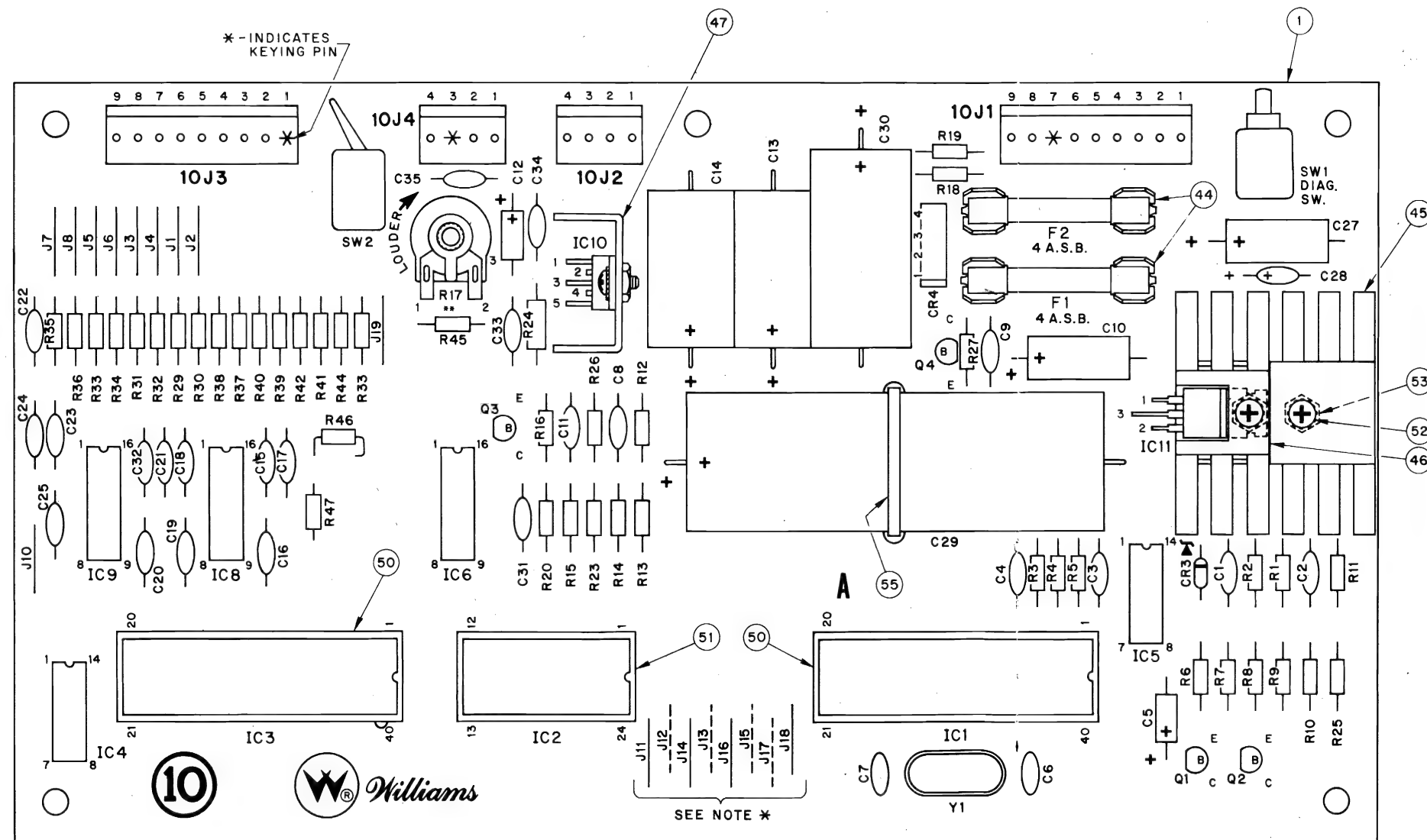
BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5113-09474-00	P.S. BOARD	P.S. BOARD	1
2	5010-09085-00	R4	RESISTOR, 1.5K 5%, 1/4W	1
3	5010-09541-00	R8, R7	RESISTOR, 2.7K 2%, 1/4W	2
4	5010-09508-00	R5	RESISTOR, 270 2%, 1/4W	1
5	5010-09428-00	R3	RESISTOR, 1.5K 2%, 1/4W	1
6	5010-09509-00	R11	RESISTOR, 1.1K 2%, 1/4W	1
7	5010-09510-00	R13	RESISTOR, 12K 2%, 1/4W	1
8	5013-09542-00	R10	RESISTOR, 732K 1%, 1/4W	1
9	5013-09427-00	R1 & R9	RESISTOR, 499K P/O 1/4W	2
10	5013-09426-00	R2	RESISTOR, 2.15K P/O 1/4W	1
11	5012-09423-00	R6	RESISTOR, 12Ω, 5%, 5W	1
12	5012-09512-00	R14	RESISTOR, 27 5%, 5W	1
13	5040-09421-00	C3 & C7	CAPACITOR, 100MFD, 25V, RADIAL	2
14	5040-09422-00	C2	CAPACITOR, 47MFD, 50V, RADIAL	1
15	5040-09420-00	C6	CAPACITOR, 1000MFD, 25V, RADIAL	1
16	5040-09419-00	C12	CAPACITOR, 18,000MFD, 20V, RADIAL	1
17	5040-09423-00	C4	CAPACITOR, 330MFD, 10V, RADIAL	1
18	5040-09504-00	C13	CAPACITOR, 4700MFD, 35V, RADIAL	1
19	5043-08996-00	C5, C8, C11	CAPACITOR, 1MFD, 50V, AXIAL ±5%	3
20	5043-09065-00	C1	CAPACITOR, 470PFD, 50V, AXIAL X7R	1
21	5043-09492-00	C9	CAPACITOR, 100PFD, 50V, AXIAL ±5%	1
22	5040-09506-00	C14	CAPACITOR, 220MFD, 16V, RADIAL	1
23	5040-09493-00	C10	CAPACITOR, 22MFD, 10V, RADIAL	1
24	5070-06258-00	D1, D2, D3	DIODE, 1N4001	3
25	5100-09418-00	BR1	BRIDGE RECTIFIER, 35AMP, 100V	1
26	5100-09513-00	BR2	DIODE BRIDGE, 40A, 50V	1
27	5100-09514-00	BR3	DIODE BRIDGE, 10A, 50V	1
28	5731-09432-00	F1, F2	FUSE, 7A, 5B	2
29	5731-06314-00	F3	FUSE, 4A, 5B, 250 V.	1
30	5731-06569-00	F4	FUSE, 1A, 5B	1
31	B-8416-00		HEAT SINK ASSEMBLY (SEE A)	1
32	5705-09543-00		HEAT SINK	1
33	5791-09074-00	4J2	HEADER, 15 PIN, 09-65-1151	1
34	5791-09043-00	4J1	HEADER, 12 PIN, 09-65-1121	1
35	5250-09515-00	Q2	VOLTAGE REGULATOR 7905	1
36	5460-09424-00	IC1, IC2	VOLTAGE REGULATOR 783	2
37	5824-09248-00	TP2, TP3, TP5, TP6	TERMINAL #1502-1 (TEST POST)	4
38	20-9229-00		THERMAL COMPOUND .02 OUNCE	AR
39	4005-01051-07		5-40x7/16 RH. MECH. SCREW	6
40	4405-01117-00		5-40 HEX NUT	6
41	5161-09552-00	Q1	2N3055 TRANSISTOR NPN	1
42	5731-09651-00	F5	FUSE, 5A, 5B	1
43	5791-09038-00	4J3	HEADER, 6 PIN, 09-65-1061	1
44	5012-09544-00	R15	RESISTOR, 2.0Ω, 5%, 5W	1
45	5010-09416-00	R16, R18	RESISTOR, 470Ω, 5%, 1/4W	2
46	5010-09314-00	R17	RESISTOR, 1.2K, 5%, 1/4W	1
47	5701-09538-00		INSULATOR, MICA, 3mil	1
48	5671-09019-00	LED1, LED2, LED3	LED, RED	3
49	03-7598		INSULATOR, NYLON	2
50	03-7520		TIE WRAP	1
51	5732-09178-00		FUSE HOLDER	10



BILL OF MATERIALS			
ITEM	PART N ^o	DESCRIPTION	QTY.
1	11-580	POWER SUPPLY MTG. BD.	1
2	01-7001	POWER SUPPLY GND. PLATE	1
3	01-7002	POWER SUPPLY SUPPORT BRKT.	2
4	D-8359	POWER SUPPLY BOARD	1
5	C 8529	VIDEO TRANSFORMER ASSY	1
6	B-6448-1	FUSE MOUNT ASS'Y.	1
7	5731-08633-00	LINE FUSE 3AMP 115/V	1
8	5102-08895-00	LINE FILTER 5A	1
9	01-6948-	OUTLET MTG. BRACKET	1
10	03-6048-6	CABLE CLAMP- 3/8	2
11	SEE NOTE #2	LINE CORD	1
12	4006-01018-04	MS. #6-32 x 1/4 P-RH	4
13	4108-01022-08	SMS # 8-32 x 1/2 P-RWH-A	13
14	5851-09184-00	3 WIRE SNAP-IN OUTLET	1
15	SEE NOTE #1	VARIATOR	1
16	4408-01117-00	NUT 8-32 HEX	4
17	20-9223-3	6 INCH BRAIDED GROUND WIRE	1
18	20-9256	1 INCH SLEEVING INSULATION	2
19	4703-00008-00	NO. 8 EXTERNAL LOCK WASHER	4
20	5825-06523-00	TERMINAL LUG	1
21	5852-09575-00	BLACK-18 AWG JUMPER WIRE-25'L	1
22	4008-01005-22	MS. 8-32 x 1 3/8 P-PH	4
23			



- NOTES:
1. FOR 115V.A.C., 130V. VARIATOR # 5017-09044. IS USED.
FOR 230V.A.C., A 275V VARIATOR # 5017-09063 IS USED.
2. LINE CORD PART NUMBERS:
5850-06206-00 12 FT. EUROPE
5850-08728-00 U.S. DOM.
5850-08737-00 AUS.
5850-08743-00 U.S.L.A.
5850-09128-00 12 FT. FRANCE
5850-09131-00 AWG 18-12 JAPAN



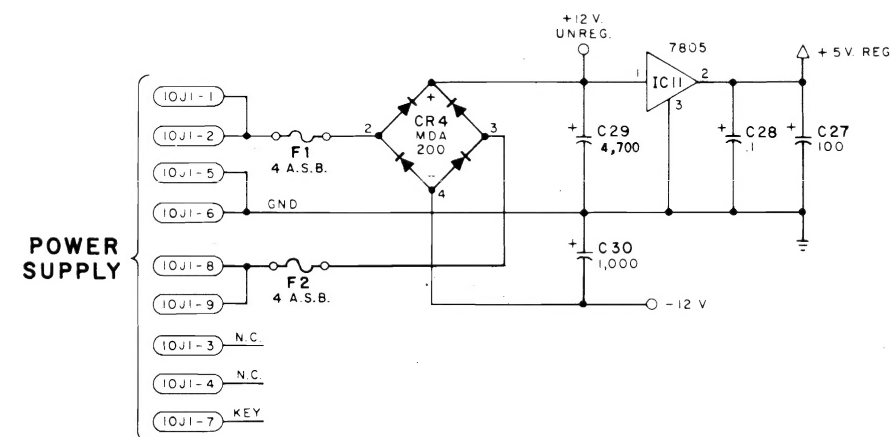
*** NOTE:**

JUMPERS SHOWN WITH SOLID LINES CONNECTED FOR PROM OPERATION. THOSE SHOWN WITH DASHED LINES CONNECTED FOR ROM OPERATION.

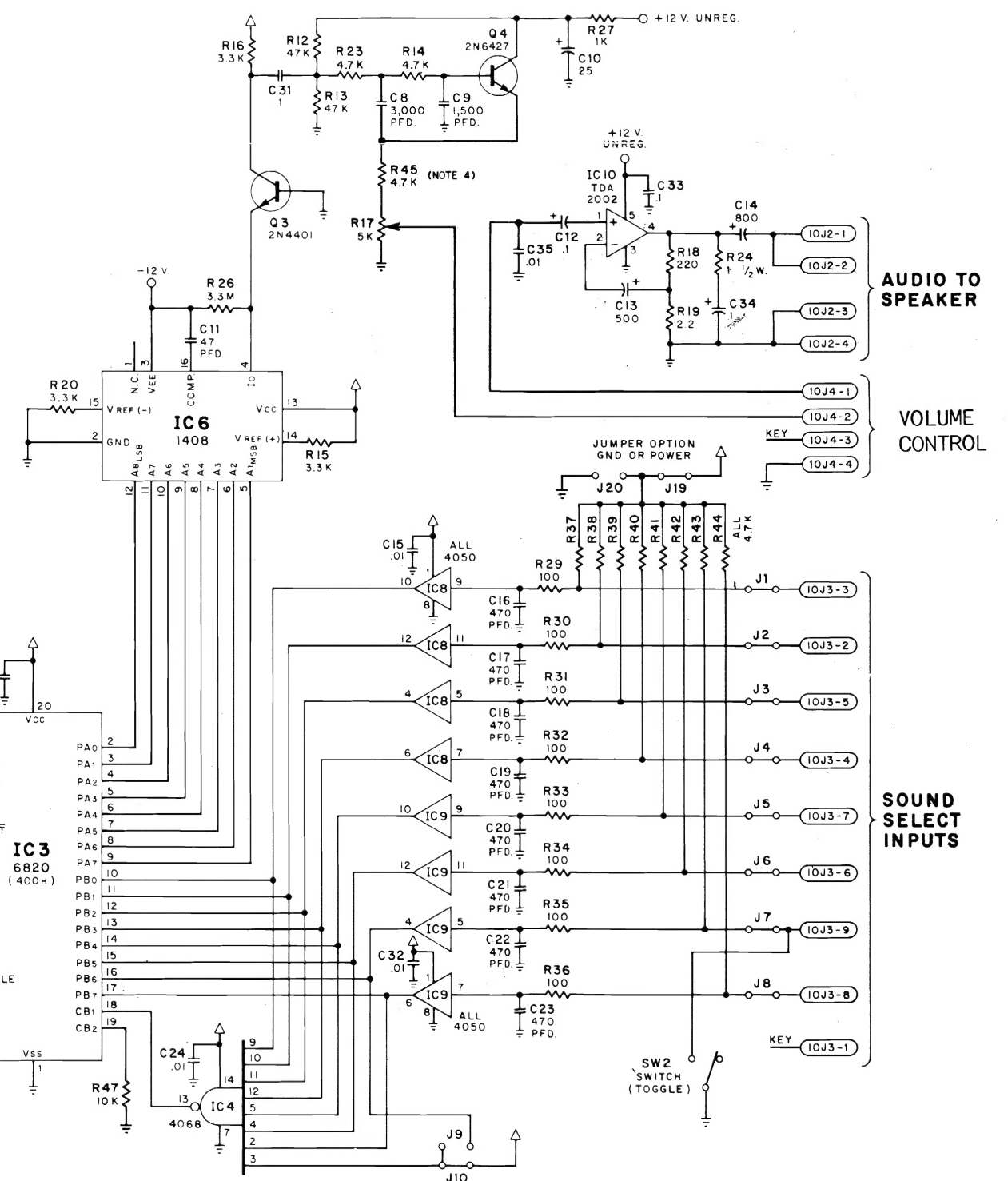
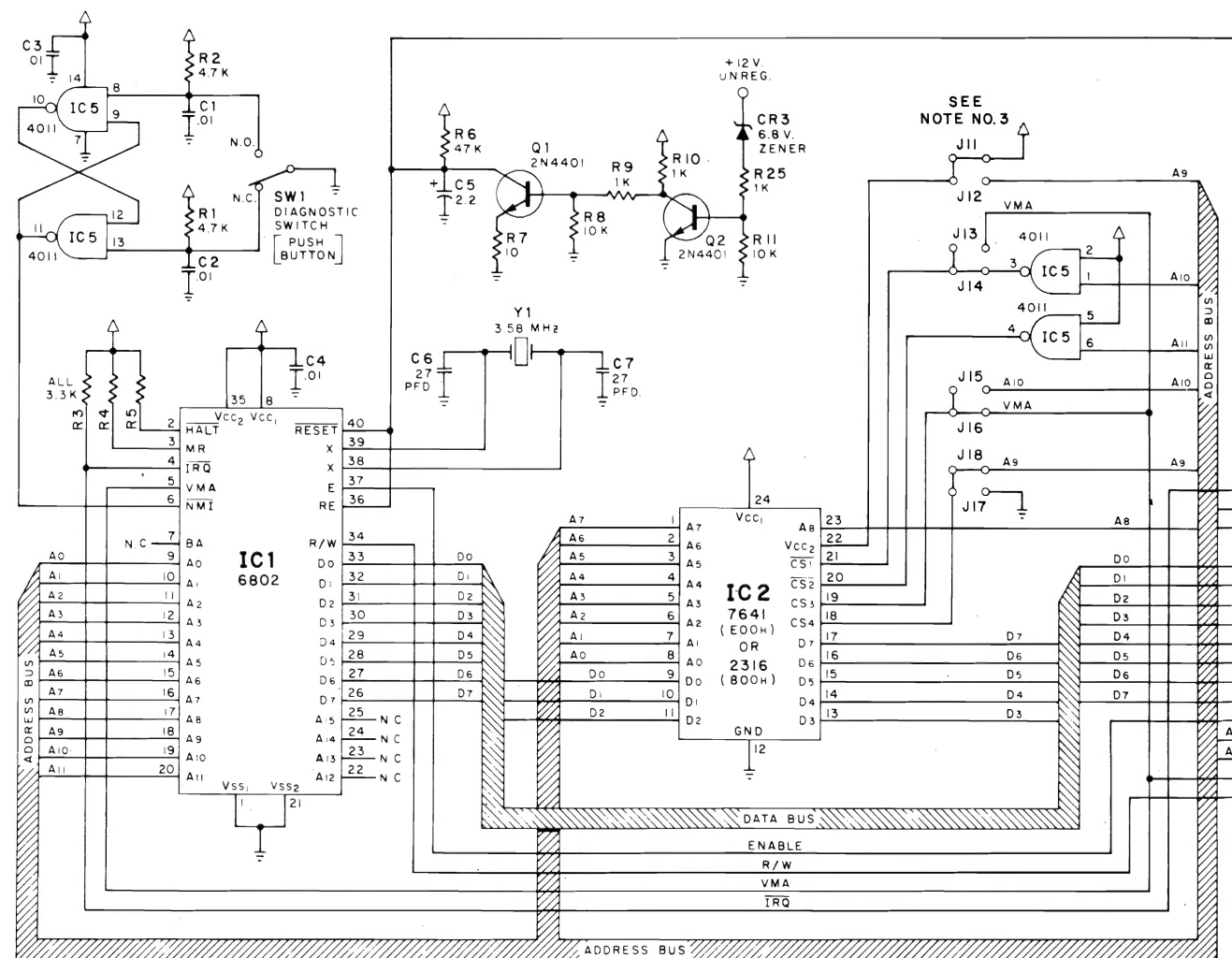
BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
1	1B-2001-137		BARE P.C. BOARD	1
2	5A-8972	IC3	MC6820 PIA	1
3	5A-9154	IC4	4068 8 INPUT NAND GATE	1
4	5A-9155	IC5	4011 QUAD 2 INPUT NAND GATE	1
5	5A-9152	IC6	MC1408 D/A CONVERTER	1
6	5A-9153	IC8, IC9	4050 BUFFER	2
7	5A-9156	IC10	TDA2002V AUDIO AMPLIFIER	1
8	5A-9157	IC11	7805 5 VOLT REG. W/T0220 CASE	1
9	5C-8938	Q1, Q2, Q3	2N4401 NPN TRANSISTOR	3
10	5A-8976	Q4	2N6427 NPN TRANSISTOR	1
11	5A-9018	CR3	1N5996 6.8 V ZENER DIODE	1
12	5A-9158	CR4	MDA200/3N253 BRIDGE RECTIFIER	1
13	5B-8991	R1, R2, R14, R23, R37 THRU R45	RESISTOR, FC, 4.7 K OHM 10% 1/4 W	13
14	5B-8983	R3, R4, R5, R15, R16, R20	RESISTOR, FC, 3.3 K OHM 10% 1/4 W	6
15	5A-8984	R9, R10, R25, R27	RESISTOR, FC, 1 K OHM 10% 1/4 W	5
16	5B-9039	R7	RESISTOR, FC, 10 OHM 10% 1/4 W	1
17	5B-8817	R8, R11, R46, R47	RESISTOR, FC, 10 K OHM 10% 1/4 W	4
18	5B-9035	R6, R12, R13	RESISTOR, FC, 47 K OHM 10% 1/4 W	3
19	5A-9160	R18	RESISTOR, FC, 220 OHM 10% 1/4 W	1
20	5A-9161	R19	RESISTOR, FC, 2.2 OHM 10% 1/4 W	1
21	5A-9179	R26	RESISTOR, FC, 3.3 M OHM 10% 1/4 W	1
22	5B-9036	R29 THRU R36	RESISTOR, FC, 100 OHM 10% 1/4 W	8
23	5A-9181	R24	RESISTOR, FC, 1 OHM 10% 1/2 W	1
24	5A-9376	C29	CAPACITOR, ELECTROLYTIC, 14,700 MFD. 16 V.	1
25	5A-8986	C27	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V.	1
26	5A-8893	C30	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V.	1
27	5A-9164 5A-9164-1	C13	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V.	1
28	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V.	1
29	5A-9168 5A-9168-1	C10	CAPACITOR, ELECTROLYTIC, 25 MFD. 20 V. OR 33 MFD. 16 V.	1
30	5A-9031	C12	CAPACITOR, TANTALUM, 1 MFD. 25 V.	1
31	5A-9163	C5	CAPACITOR, TANTALUM, 2.2 MFD. 15 V.	1
32	5A-8980	C1 THRU C4, C15, C24, C25, C32, C35	CAPACITOR, CERAMIC, .01 MFD. 50 V.	9
33	5A-8996	C28, C31, C33, C34	CAPACITOR, CERAMIC, .1 MFD. 50 V.	4
34	5A-9169	C6, C7	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V.	2
35	5A-9065	C16 THRU C23	CAPACITOR, CERAMIC DISC, 470 PFD. 50 V.	8
36	5A-9166	C9	CAPACITOR, CERAMIC DISC, .0015 MFD. 1K V.	1
37	5A-9167	C8	CAPACITOR, CERAMIC DISC, .003 MFD. 1K V.	1
38	5A-9180	C11	CAPACITOR, CERAMIC DISC, 47 PFD. 1K V.	1
**39	5A-9185	R17	POTENTIOMETER, 5K OHM	1
40	5A-9020	Y1	CRYSTAL, 3.58 MHZ.	1
41	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
42	5A-9171	SW2	TOGGLE SWITCH SPDT	1
43	5A-6314	F1, F2	4 AMP. SLOW BLOW FUSE	2
44	5A-9178		FUSEHOLDER	4
45	5A-9172		HEAT SINK THERMALLOY #6072B	1
46	5A-9173		HEAT SINK THERMALLOY #6071B	1
47	5A-9199		HEAT SINK THERMALLOY #8030	1
48	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
49	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
50	5A-8985		40 PIN SOCKET	2
51	5A-9004		24 PIN SOCKET	1
52			6-32 X 3/8 BINDER HEAD SCREW	2
53			6-32 HEX. NUT	2
54		J1 THRU J8, J10, THRU J19	WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	18
55	3A-7520-1		TIE WRAP	1
56	5A-9150	IC1	MC6802 MICROPROCESSOR	1
57	5A-9264	IC2	VIDEO SOUND ROM 1	1

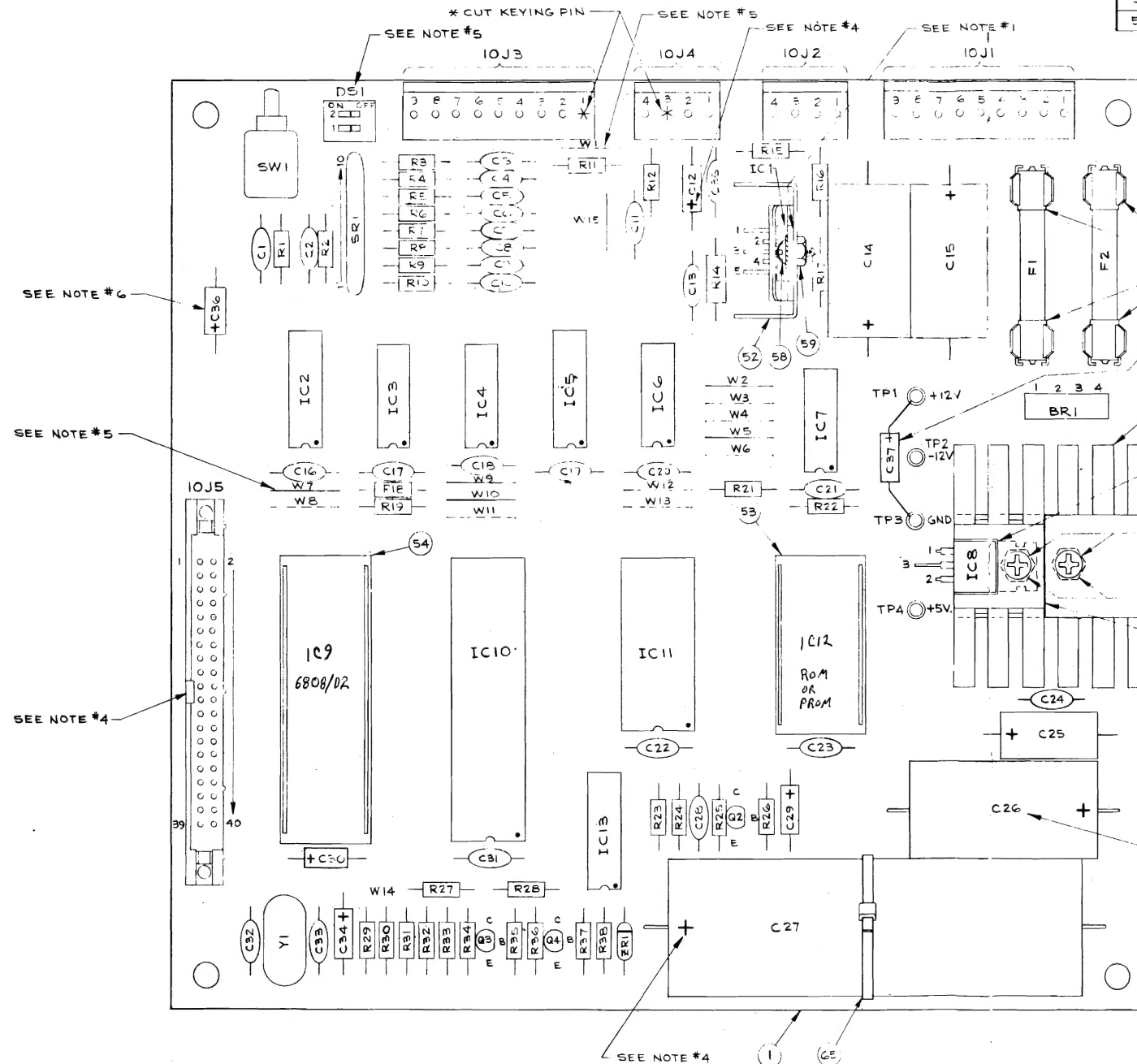
**ON MOST BOARDS, R17 IS REMOVED AND A JUMPER CONNECTED BETWEEN TERMINALS 1 AND 2.



- NOTES:**
1. UNLESS OTHERWISE INDICATED ALL RESISTORS IN OHMS, 1/4 WATT.
 2. UNLESS OTHERWISE INDICATED ALL CAPACITORS ARE IN MICROFARADS.
 3. J11, J14, J16, AND J18 ARE REMOVED AND J12, J13, J15, AND J17 ARE CONNECTED.
 4. ON MOST BOARDS R17 IS REMOVED AND R45 IS CONNECTED THROUGH A JUMPER TO 10J4-2.



ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
58			6-32 x 3/8" BINDER HEAD SCREW	3	48	5A-9314	F1, F2	4 AMP SLOW BLOW FUSE	2
59			6-32 HEX NUT	3	49	5A-9178		FUSEHOLDER	4
60			WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	7	50	5A-9172		HEAT SINK THERMALLOY*6072B	1
61	5A-9248	TP1 THRU TPA	TERMINAL #1502-1	4	51	5A-9173		HEAT SINK THERMALLOY*6071B	1
62	5A-9363	R11	RESISTOR, FC, 5.6 K OHM 5% 1/4 WATT	1	52	5A-9199		HEAT SINK THERMALLOY*6030	1
64	5A-9362	SRI	RESISTOR, 4.7 K OHM 10 PIN SIP	1	53	5A-9004		24 PIN SOCKET	1
65	3A-7520-1		TIE WRAP	1	54	5A-8985		40 PIN SOCKET	1
					55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
					56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
					57	5A-9349	10J5	40 PIN RIBBON HEADER	1



NOTES:

- USE THERMAL COMPOUND BETWEEN ICs AND HEAT SINK.
- CAUTION: AVOID STATIC DISCHARGE DAMAGE TO MOS LOGIC.
- SYMBOLS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY. DO NOT SCREEN OR STAMP.
- OBSERVE INDEX MARK OF ALL INTEGRATED CIRCUITS, DIODES D1, D2, AND Z1.
- CAPACITORS C12, C14, C15, C16, C17, C27, CONNECTORS 10J1, 10J2, 10J3, 10J4, 10J5, POSITIVE OF TRANSISTORS Q1, Q2, Q3, Q4.
- D1 - 1 SELECTS SOUNDS/NOTES
2 SELECTS SPEECH/NO SPEECH (W9/W1)
W1 - SPEECH MODULE STATUS
IN - SPEECH MODULE NOT ATTACHED
OUT - SPEECH MODULE ATTACHED
W14 - MPU INTERNAL RAM ENABLE
W7 & W8 - MEMORY MAP CONTROL
W12 & W13 - P8 STATUS CONTROL (W13 NEVER USED)
W4 & W9 - P85 STATUS CONTROL
6. SOLDERED ON TOP OF BOARD
INSTALL THESE JUMPERS FOR FOLLOWING GAMES:
W15, W6, W12, W4, W1, W3, W6, W11 FOR:
 - WORLD CUP
 - DISCO FEVER
 - CONTACT
 - POKERNO
 - PHOENIX
 - ARISTOCRAT SHUFFLE
 - POMPLI SHUFFLE
 - KING TUT SHUFFLE
 - TAURUS SHUFFLE
- W15, W6, W12, W4, W1, W3, W6, W11, FOR:
 - FLASH
 - STELLAR WARS
 - TRI ZONL
 - TIME WARP
- W7, W15, W9, W1, (SEE NOTE #5) W2, W5, W10 FOR:
GORGAR, SOUND ROM 2 - JT-1960
- IC12 SELECTION STRAPPING:
 - (2K x 8) W2
 - (1K x 8) W3
 - (512 x 8) W4
 - W5 - IN
 - W6 - IN
 - W7 - IN

BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	IC-2001-146-3		BARE P.C. BOARD	1
2	5A-9156	IC1	TDA2002 V AUDIO AMPLIFIER	1
3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	5A-8973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5A-9153	IC5	4050 BUFFER	1
7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	5A-8971	IC7	14069 HEX INVERTER	1
9	5A-9157	IC8	7805 5 VOLT REG. W/TO220 CASE	1
10	5A-8972	IC10	6821 P.I.A.	1
11	5A-9003	IC11	6810 RAM	1
12	5A-9152	IC13	1408 D/A CONVERTER	1
13	5C-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5A-9018	Z1	1N5996 6.8V. ZENER DIODE	1
16				
17	5A-9158 OR 5A-9357 5A-9020	BR1	MDA 200/3N253 BRIDGE RECTIFIER	1
18		Y1	3.58 MHz CRYSTAL	1
19	5B-8991	R1, R18, R19, R21, R22, R27, R30, R31, R32	RESISTOR, FC, 4.7 K OHM 5% 1/4 WATT	9
20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10% 1/4 WATT	9
21	5A-8984	R12, R15, R28, R36, R38	RESISTOR, FC, 1K OHM 10% 1/4 WATT	5
22	5A-9181	R14	RESISTOR, FC, 1 OHM 10% 1/2 WATT	1
23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 10% 1/4 WATT	1
24	5A-9361	R17	RESISTOR, FC, 220 OHM 10% 1/2 WATT	1
25				
26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3K OHM 10% 1/4 WATT	3
27	5A-9179	R25	RESISTOR, FC, 3.3 M OHM 10% 1/4 WATT	1
28	5A-9359	R29	RESISTOR, FC, 47 K OHM 5% 1/4 WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K OHM 10% 1/4 WATT	3
30	5B-9039	R34	RESISTOR, FC, 10 OHM 10% 1/4 WATT	1
31	5A-8980	C1, C16 THRU C23 C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50 V. ±20%	9
33	5A-9345	C11	CAPACITOR, CERAMIC, .001 MFD. 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAPACITOR, ELECTROLYTIC 1 MFD. 6.3 V. 10% 50%	3
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	3
36	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	5A-9164 5A-9164-1	C15	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V. ±20%	1
38	5A-8986	C25	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V. ±20%	1
39	5A-8893	C26	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V. ±20%	1
40	5A-9046	C27	CAPACITOR, ELECTROLYTIC, 12,000 MFD. 16 V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25 V. LOW LEAK 10%	1
43	5A-9169	C32, C33	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V. ±10%	2
44	5A-9163	C34	CAPACITOR, TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAPACITOR, TANTALUM, 1 MFD. 25 V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	D51	2 STD. DIP SWITCH	1

TOLERANCES		QTY.	ASSEMBLY ON
UNLESS OTHERWISE SPECIFIED:		WILLIAMS ELECTRONICS, INC.	
FRACTIONAL	21/64"	3401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240	
DECIMAL	±.005"	NAME	
HOLE DIA.	±.005 - .0001"	SOUND BOARD SUB-ASSEMBLY	
ANGULAR	±1/2°	MATERIAL	HEAT TREATMENT
CONCENTRICITY	±.001"	FINISH	
SCREW THREADS	CLASS 2	DATE	SCALE
		9-23-79	2:1
		DATE	D-8223

